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The Chemical Age

A Weekly Journal Devoted to Industrial and Engineering Chemistry

VOL. XLVIII
No. 1238

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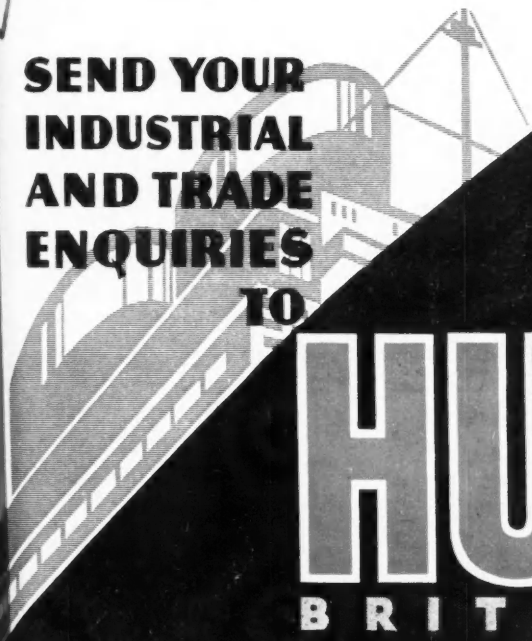

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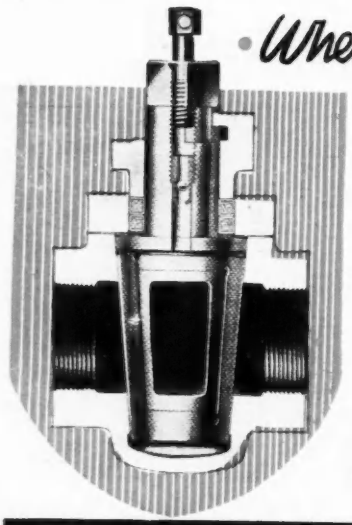

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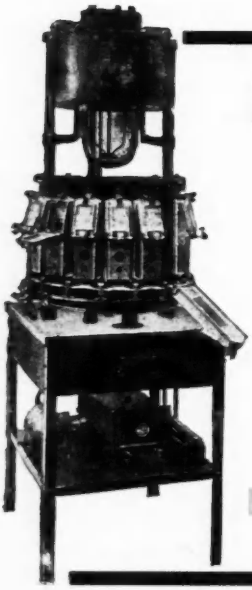

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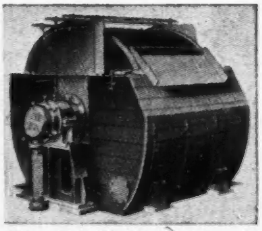

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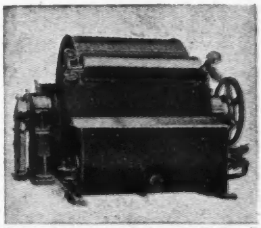

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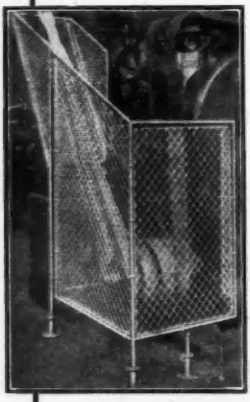

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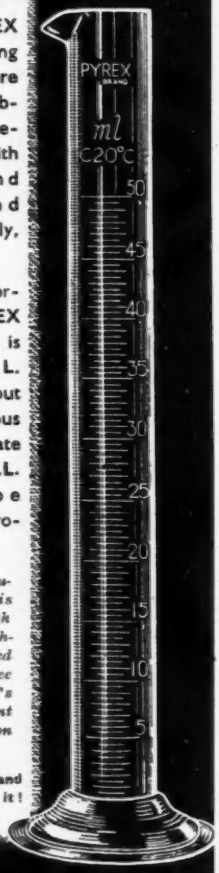

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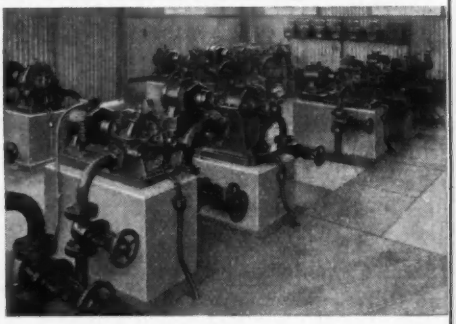

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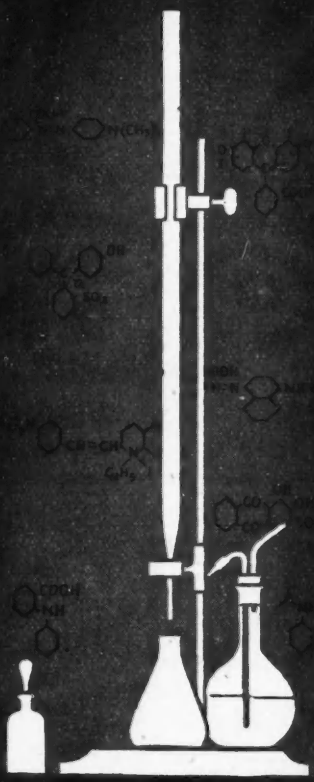

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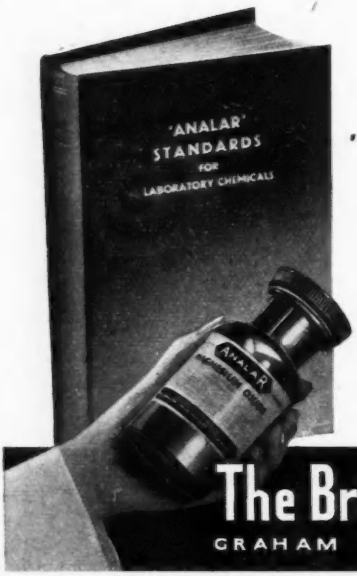

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March 20, 1943

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Liquid Distribution in Porous Materials

A GREAT deal of scientific and practical interest is being evinced in the boundaries of solids. Many chemical reactions, many physical phenomena, many industrial applications of both depend upon the physico-chemical effects at these boundaries. The work of Rideal and others on the mechanism of hydrogenation, discussed in our issue of January 23, was based upon the reactions of absorption and adsorption at the boundary of the solid, and the subsequent interactions of the substances concentrated there. Another aspect of this important and interesting subject was described by Dr. R. K. Schofield of the Rothamsted Experimental Station in a paper presented to the Institute of Physics upon "The Distribution of a Liquid in a Pore Space." This paper was not without application to the adsorption of substances on solids, but may probably be better considered as having an application to drying technique.

Dr. Schofield's objective in undertaking the work was the study of soil drainage, and the mechanism by which water is held in the soil, and can be then made available to plants. It obviously has a direct application to the drying of clays and similar materials, and ultimately to any porous solids in contact with a liquid or condensable vapour. The experimental methods involved the study of equilibria between the liquid in the wetted solid—clay, soil, or Portland Stone—and sulphuric acid of known strength having a known vapour pressure. In putting this experimental method into effect, the absorption of vapour by the solid, and the desorption or drying of the solid were studied, thus allowing the detection of any hysteresis effect. When there is no hysteresis effect, the inference can be drawn that the liquid is being taken up in the solid by an adsorption effect, involving the condensation of molecular layers of the substance on the solid within the pores. When hysteresis occurs the adsorption effect is replaced by, or at least overshadowed by, the capillarity effect, the liquid fills up the pores, forming a meniscus, and the action is similar to that which takes place in any capillary tube. This applies equally to absorption or desorption. In the one the pores are filled and in the other liquid runs out of the pores.

Soils and clays are essentially packed spheres of minute size, The shape of the particles may not be truly spherical, but mathematically

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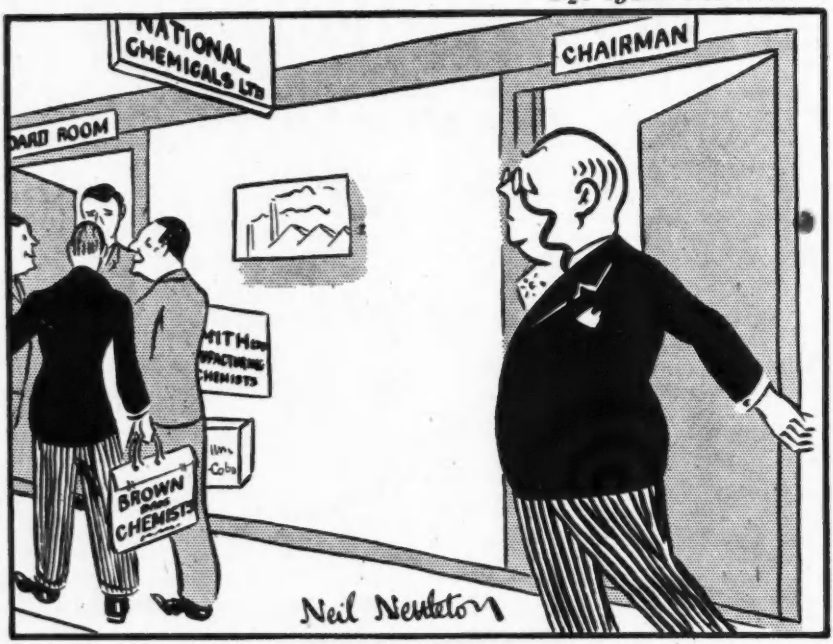
N_2O by Neil Nettleton



CO-OPERATION

Chairman: "Things seem to have changed since my young days."

they can be treated as such. In clay, for example, the average size of the particle is of the order of 0.1μ (10^{-4} cm.), and by considering the shape of the cavities in a number of packed spheres it is evident that the capillary spaces are still smaller. It is also clear, and this is important, that the pores in these materials are not true capillary tubes, but are irregular in shape, consisting of alternate wider and narrower passages. It was found experimentally that the narrower passages constitute a resistance to the flow of liquor into or out of the pores of the material. If the water table drops in soil drainage, the larger passages are drained fairly quickly. The smaller passages, however, hardly drain at all. The well-known law of capillary flow, $V = p\pi a^4/8L\eta$ where V is the volume of liquid flowing through a capillary in unit time with a pressure difference of p and with a capillary diameter a, readily exlains this, since the flow in these minute capillaries for which a may be of the order of 1×10^{-6} cms. is very slow indeed. This applies to drainage from a porous solid. For drying by evaporation, it is found that the wider pores dry readily, requiring comparatively little energy head, whereas at the constrictions there is a decided resistance. The adsorbed layer remains until last and requires a very considerable energy head for its removal.

Thus, the absorption of liquid (or vapour) by a porous solid consists first of the adsorption on the surface of the pores or capillaries of a film of the fluid of the order of one or two molecules thick. This may suffice to fill up the whole cross-section of the pore. If not, further fluid can flow into the pore, filling up the capillaries and forming a meniscus, this flow being governed by the laws of flow in capillary tubes. When the flow is outward, *i.e.*, in draining and drying, the

order of events is reversed and the major resistance to drying arises from the small radius of curvature of the " bottlenecks ", which connect the larger pores.

This work will evidently be of considerable value in agriculture and from the results obtained Dr. Schofield was also able to answer many problems of soil drainage. How far it will have a practical influence on industrial drying technique it is difficult to say. Like most experimental work of the more abstruse character it awaits an interpreter. Nothing is lost, however, by an exact knowledge of mechanism and there are probably applications in, for example, the drying of clay shapes, bricks, pottery, and porcelain. As an illustration, it was found that when shrinkage occurs in drying, the first—and probably most serious—effect is that a shrinkage occurs directly measurable from the volume of water evaporated. When this stage has passed, air begins to enter to take the place of the water and the shrinkage per unit evaporated presumably decreases.

NOTES AND COMMENTS

Healthier, Safer Work

DEVELOPMENT of the use of safer materials and more effective safeguards is one of the main objectives of the new Industrial Health Advisory Committee which has been set up by Mr. Ernest Bevin to extend and co-ordinate the work that is being done in industrial medicine and hygiene. It will not displace, but will act in conjunction with, the existing Industrial Health Research Board. The new body will be concerned with inquiry rather than research, and, from reports we have heard of certain Government establishments, there is room for unbiased and skilled inquiry. Mr. Bevin is evidently taking the matter seriously, for he has appointed himself chairman of the new committee, with Mr. George Tomlinson, M.P., his Parliamentary Secretary, as vice-chairman. The committee of eighteen appears to be strong, and well-balanced between the purely medical and the more industrial side of welfare. Chemical workers will be reassured by the presence on it of Dr. J. J. Fox, the Government Chemist, whose devotion to the interests of chemical personnel is well known. We wish the committee all good fortune in their efforts towards making work healthier, safer, and pleasanter.

Storage of Industrial Coal

MOST industrial coals may be stored safely if a few simple principles are observed; but in certain circumstances stored coal may heat spontaneously, and even take fire. Spontaneous combustion, when it does occur, may be serious and must be dealt with drastically. Few industrial coal-users, we imagine, would disagree with the foregoing sentences, which form the opening paragraph of the general observations in Mr. R. A. Acton Taylor's paper on " The Storage of Coal for Industrial Purposes," which has just been issued by the Ministry of Fuel and Power. It does not follow, however, that all industrialists are aware of the " few simple principles " involved, and it is to them that the recommendations in the paper are addressed. Size of coal, ventilation, size and site of stack, observation of temperature, deterioration—all these are factors that have to be considered when the safe storage of coal is in question. Each of these questions is fully dealt with by Mr. Taylor; and when the worst has occurred, and the coal stack *has* caught on fire, he supplies a brief and simple account of the drastic measures required to deal with it on the spot. Chemical manufacturers who have had coal-store troubles are advised to pass on the information to the Ministry, both for their own good and for that of the industry in general.

Vanadium Supplies

INDICATIONS are in the air that the supplies of vanadium available to the Allies are on the up grade. From the rather indefinite news on the subject that is allowed to filter through to the public, the financial correspondent of *The Times* has made some interesting and not unreasonable deductions. Nothing further has been heard of the new deposit that was located in Ceylon last October, but it is known that vanadium alloys, both in this country and in the U.S., are helping

in increased volume to meet the tungsten shortage. The United States Government, besides absorbing the whole of the current vanadium production of Peru and Mexico, has initiated, through the Metals Reserve Company, a programme of expansion in Colorado, Utah, and Nevada. As a result it is expected that the country's output this year will be double that of 1941. There is no recent information about vanadium production in South-West Africa and Northern Rhodesia, the two most important British producing areas. As vanadium output provides only a very small part of the revenues of the three producing companies—the South-West Africa Co., the Otavi Mines and Railway Co., and the Rhodesia Broken Hill Development Co. —their accounts cannot be regarded as a gauge of vanadium production, but at all events it can be said that there is still room for further sources of production to ensure adequate supplies.

The Need for Stability

SIR ERNEST BENN, chairman of the United Kingdom Temperance and General Provident Institution, has circulated for its annual general meeting a statement dealing, among other subjects, with post-war prospects and national extravagance. We take from that statement the following passages: "Schemes for post-war reconstruction are in the air, plans are propounded to solve our problems from infancy to second childhood. Yet the most serious problem of all is clothed in an impenetrable shroud of secrecy. After the 1914-18 war the whole of Europe was engulfed in a sea of paper currency and six countries suffered the miseries of a complete currency collapse. There can be little doubt that history will repeat itself, and there is no need to stress the imperative necessity to keep our paper currency stable. If the Government fails to raise sufficient revenue by taxation and genuine borrowing to meet its heavy commitments, and has to resort to the expedient of printing new paper currency or borrowing new sums from the banks, nothing can prevent a further fall in the value of our money. Unless, therefore, the people will make up their minds to increase still further their investments in war loan, it is difficult to see how the mounting inflation can be stemmed."

Experiments in Expenditure

"WE have always regarded our Institution and its work as high-grade social service," he goes on to say. "When war's afoot we must accept grievous limitations on our power to serve. Our personnel and our resources are, therefore, wholly at the disposal of the State for the purpose of defeating the enemy. When, however, the needs of war have been satisfied, and all that is useful for war has been taken, it is permissible to apply remaining energies to the maintenance of the peace-time social and economic structure. There are people who imagine they are helping to win the war by merely changing work they understand for new and untried occupations. Too large a part of the national expenditure of £14,000,000 a day is used for novel, experimental, and extraneous plans and purposes, some of them having nothing whatever to do with the prosecution of hostilities. The use of war-time powers to transfer men and money from established forms of trade and service for other than strictly war purposes should surely be avoided."

German Sulphuric Acid

THE cessation of German imports of pyrites from North Africa, which formerly supplied three-quarters of the raw material for the Reich sulphuric acid production, has restricted German output of this acid. This has been partly offset, however, by increased domestic production of pyrites, recovery of sulphur from coke-oven gas and gases used in synthetic motor fuel production. There are also other less satisfactory ways of circumventing the sulphuric acid raw material difficulty, which are undoubtedly being used in increasing measure. One of them tried during the last war was the uneconomic processing of gypsum, which was abandoned after the war and then resumed in 1937 at I.G. Farben's Wolfen plant, which has been producing 80,000 tons of sulphuric acid a year by an improved process developed at Leverkusen. Gypsum is also being used instead of sulphuric acid to provide the sulphur content of ammonium sulphate in the I.G.'s huge Leuna works in Saxony. Increased recovery of sulphuric acid and carbon bisulphide used in synthetic fibre production also has probably resulted in some savings.

Petroleum in the Chemical Industry

III. — The Tertiary Products

by J. E. WALKER

(*Continued from* THE CHEMICAL AGE, *March* 13, *p.* 290.)

FROM the two preceding sections of this article it will be apparent to anyone with imagination that to carry on to a logical conclusion and examine the further possibilities of all the secondary products would be quite beyond the bounds of anything less than a treatise on organic synthesis.

The processes which can be applied to the compounds in the primary and secondary series are almost as numerous as the compounds themselves, but the main ones are probably ammination, halogenation, esterification, sulphonation, hydrolysis, oxidation, nitration, and hydrogenation. Many others, such as the Friedel and Crafts reaction and the reaction of Fittig and Perkins are of high importance, but a line must be drawn somewhere, and only basic possibilities can be included.

Selected Compounds

In order to give a general idea as to the possibilities of further synthesis, the following hydrocarbons were selected:

Primary Products: Methane; ethylene; benzene; toluene.

Secondary Products: Methyl alcohol: ethyl alcohol; *iso*propyl alcohol; *sec.* butyl alcohol; ethylene glycol; formaldehyde; acetaldehyde; phenol; nitrobenzene; benzaldehyde; benzoic acid.

Even with a shortened list of fifteen basic raw materials, it is not proposed to deal with all the products obtainable from each by further synthesis; but as far as possible, the most appropriate compounds will be selected to demonstrate the possibilities with a number of well-established reactions.

Taking the first compound on the list, methane, it is probable that from a commercial aspect, halogenation yields the most promising results. Methane can be chlorinated thermally or catalytically, and also by photochemical processes. It is possible to chlorinate satisfactorily with either gaseous chlorine in the presence of a metallic chloride catalyst, *e.g.*, antimony trichloride; by hydrogen chloride and air over a copper catalyst; or by the use of sulphuryl chloride and a carbon catalyst. The predominating product is methyl chloride, but accurate control of processing and degree of chlorination has led to excellent yields of methylene chloride and of chloroform.

When antimony trichloride is used as catalyst the process is usually carried out in the vapour phase, under slight pressure. The usual temperatures lie between 230° and 270° C., when the catalyst itself is also vaporised. This process will yield all three chloromethanes, and can be adjusted to give maximum yields of either, at short notice, *i.e.*, it is a flexible process. If methyl chloride is the only product desired, then the process utilising hydrogen chloride is frequently employed, while the use of sulphuryl chloride has given the best yields of chloroform. Furthermore, continued chlorination of chloroform yields carbon tetrachloride, while hydrolysis of methyl chloride yields methyl alcohol.

Wide Scope of Halogenation

Using bromine as the halogenating agent leads to the production of the corresponding series of bromo-derivatives—indeed, the list is ever-widening, and a halt must be called, for it should be realised that all other paraffins, from ethane up to the solid waxes, can be halogenated by the selection of a suitable catalyst, yielding a vast number of valuable compounds from refrigerants like ethyl chloride, explosives ingredients such as hexachlorethane, and extreme-pressure lubricants from chlorinated wax. Halogenated methane alone yields refrigerants, anæsthetics and solvents, most of which also serve as intermediates for further synthesis.

Taking ethylene, the next compound on the "short list," we find, as might be expected, that the possibilities of reactions with the olefines are much greater than with the so-called inert paraffins. This is, of course, due to the fact that the olefines can combine addi-

tively, whereas the paraffins do so only by substitution. Oxidation and hydration of ethylene have already been referred to, and will not be considered again. In addition, ethylene esterifies quite easily with many acids, *e.g.*, sulphuric acid, and acetic acid with a strong acid catalyst. It can also be sulphonated by passing it through a mixture of sulphur dioxide and sulphur trioxide, and yields of some 90 per cent. of crystalline carbyl sulphate obtained.

Ethylene Dichloride

However, it is again with halogenation that the most interesting results are obtained, and with such reactive bodies as the olefines this process is simple to carry out. Ethylene dichloride and ethylene dibromide are both easily manufactured, and it should be remembered that ethylene dichloride is itself a most important intermediate. Hydrolysis of the dichloride with aqueous sodium carbonate gives ethylene glycol, while interaction with ammonia gives ethylene diamine.

In passing, it is interesting to note that allyl chloride can be manufactured by a process recently patented for the dehydrohalogenation of propylene dichloride, while methallyl chloride can be produced by the direct halogenation of *iso*butylene, provided that the contacting time is kept sufficiently short, *e.g.*, one-fifth of a second, or thereabouts. Another interesting use for ethylene dichloride is in the manufacture of vinyl chloride, one of the most important raw materials for the plastics industry.

In contradistinction to methane, however, ethylene may be chlorinated with hypochlorous acid to yield ethylene chlorohydrin. Present practise is to carry out the process under a pressure of about 200 atmospheres, thereby greatly increasing the solubility of the ethylene in the alkaline solution of lime. This solution of ethylene is then contacted with the required amount of halogen, and the resulting ethylene chlorohydrin/calcium chloride solution withdrawn, and the chlorohydrin separated. If desired, however, the mixture can be used direct for the production of ethylene glycol. Ethylene chlorohydrin has an exceedingly important place in chemical synthesis, and its properties are too well known to need further emphasis, but it is interesting to note that, with urea or methylurea, ethylene chlorohydrin can be condensed to yield valuable resinous products, thereby forming another link between the plastics industry and petroleum.

The Aromatic Hydrocarbons

Having dealt in this summary fashion with some very important compounds, we next consider briefly the possibilities of the aromatic hydrocarbons, benzene and toluene, apart from the oxidation and nitration of benzene, which have already been mentioned. For example, by treating benzene with sulphuric acid, benzene sulphonic acid is obtained. This reaction holds good for the production of sulphonic acids from other similar aromatic hydrocarbons. While the separation of mixed sulphonic acids is difficult, the providing of a supply of pure aromatics from petroleum has led to the increasing use of pure sulphonic acids, which already have wide applications in industry. By the hydrogenation of benzene over a nickel catalyst, at temperatures varying between 150° and 200° C., all the three hydrobenzenes can be manufactured; yet once again it is through halogenation processes that the widest scope is offered.

Chlorination is usually carried out in lead or glass-lined iron vessels, the process being aided by the presence of a chlorine "carrier," *e.g.*, chlorides of iron or aluminium, or iodine. Temperature and chlorine concentration decide the proportions of mono-, di-, or trichlorobenzene produced, and each can be made the chief product, as required. It is possible to continue this process still further, and obtain higher chloro derivatives, *e.g.*, good yields of benzene hexachloride have been obtained, and naturally, by substituting bromine for chlorine, another series of compounds can be prepared.

In many ways toluene is similar in its reactions to benzene, but the presence of the alkyl side-chain, offering new possibilities, made necessary its inclusion here. It is as well to remember, too, that after the war, toluene will be one of the raw materials from petroleum in most plentiful supply. As in the case of benzene, hydrogenation of toluene leads to the formation of cyclo-aromatics, and sulphuric acid yields toluene sulphonic acid.

With halogenation, however, a very distinct difference is at once apparent, as

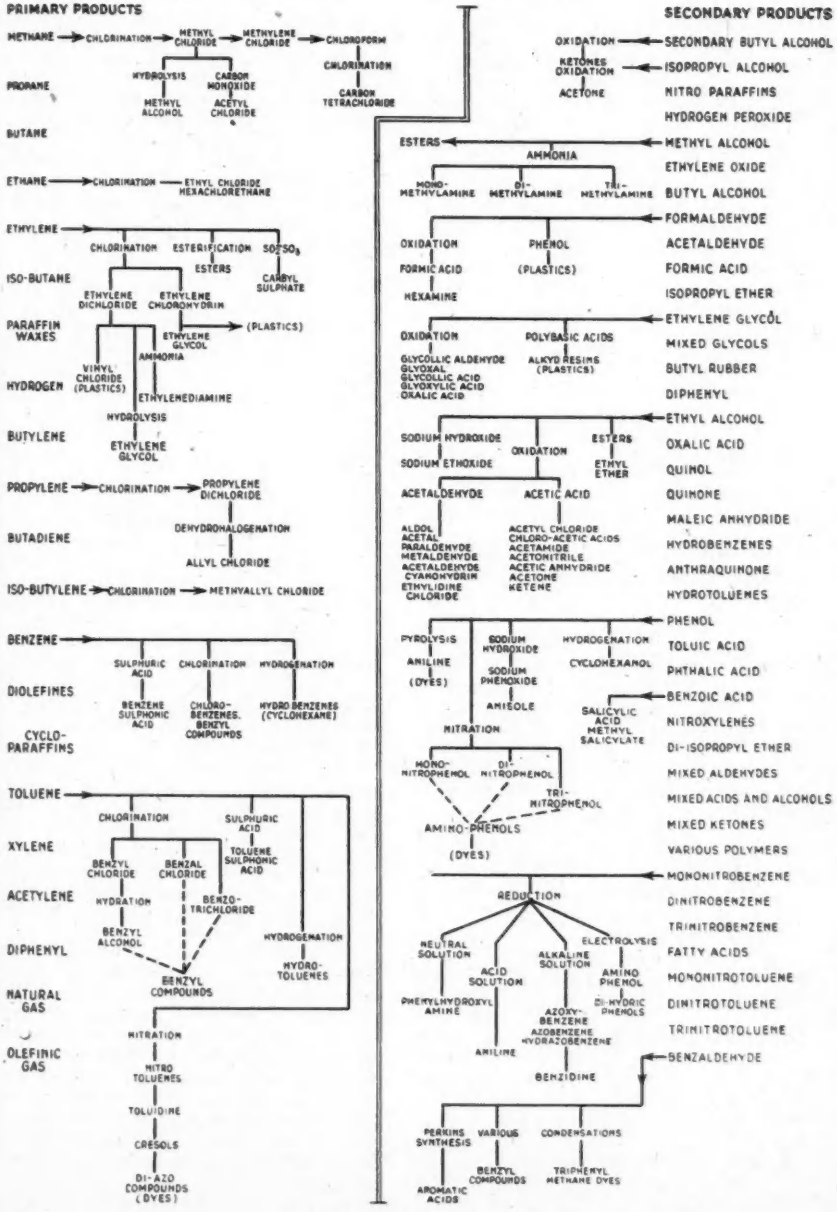


TABLE 3 TERTIARY PRODUCTS

the general tendency is for the halogen to enter the molecule in the side chain. High temperature halogenation without a catalyst favours side-chain reactions, yet one of the best methods of obtaining pure side-chain halides is by the use of ultra-violet rays, when halogenation takes place quite readily at temperatures of about 140° C. The chief products obtainable by side-chain halogenation are benzyl chloride, benzal chloride, and benzotrichloride, all of which can be obtained in a pure state, and in satisfactory yield. Halogenation with a halogen carrier leads to the formation of nucleur halides, just as with benzene.

With the three chlorides of toluene alone, the possible syntheses have increased considerably. Thus, benzyl chloride can be hydrated to yield benzyl alcohol, and at once the whole range of the benzyl compounds is opened up for exploitation. The nitration products of toluene include *o*-nitrotoluene, and it is worth noticing here that by reducing this compound, toluidine is obtained. From here it is but a short step, via diazo reactions, to the formation of cresols, and to the manufacture of azo dyes, so long the prerogative of the coal-tar industry.

Secondary Alcohols

Having inadequately covered the four chosen primary products, the alcohols of the secondary products come next, the first being methyl alcohol. The reactions of methyl alcohol are very numerous, and of great importance in industry, and some have already been considered, *e.g.*, production of formaldehyde. Since a limit must be set, the only new process that will be noted here is the production of the methylamines.

The usual method is to pass mixed methanol and ammonia vapours, preheated to about 350° C., over an aluminium oxide gel, which is at a temperature of 450° C. Products are controlled by the rate of flow of the mixed gases. Lower rates of flow favour the production of monomethylamine, and any yields of the higher methylamines can be recycled to yield further amounts of the mono-derivitive. Similarly, if the secondary, and tertiary amines are required, by the use of suitable conditions, any production of the monoamine can be re-cycled to increase the yields of the higher amines.

Thus the process is flexible, and can be adjusted to give any one of the methylamines as the main product. It seems hardly necessary to point out the great number of new syntheses again possible, using methylamines from petroleum as a starting point. With ethyl alcohol, the possibilities are even wider. Its present main uses are probably as fuel and solvent. It is now realised that it is even more important as a chemical intermediate, and a plentiful supply of cheap ethanol should be of great use to industry.

Acetaldehyde

Initial oxidation of ethyl alcohol leads to the production of acetaldehyde, and continued oxidation yields acetic acid. Although this process is not yet perfected, and has to compete with better-known and cheaper methods, it seems reasonable to assume that eventually large quantities of the aldehyde at least will be available from petroleum. In view of this, it is interesting to note a few of the compounds which can be manufactured from acetalydehyde, *e.g.*, aldol, acetal, paraldehyde, acetaldehyde, cyanohydrin, and ethylidine chloride. The possibilities from acetic acid are equally numerous, but the manufacture of acetone from calcium acetate is probably of greatest promise.

Returning to the basic material, ethyl alcohol, ethyl hydrogen sulphate is easily obtained by interaction with sulphuric acid in the cold, while heating with a further supply of alcohol yields ethyl ether. Sodium ethoxide, chloroform and numerous esters offer wide opportunities of further synthesis. Considering only one ester, ethyl bromide, another vast field is discovered, including such diverse compounds as ethylamine, butane, diethyl zinc and ethyl magnesium bromide.

So great are the ever-widening possibilities that it is very difficult to avoid slipping into the "catalogue" style, but as can be realised, very many pages would now be required just to list the available products from petroleum. Next on the list of secondary products are *iso*-propyl alcohol and secondary butyl alcohol, included because of their importance as a source of ketones, thus adding still further to petroleum chemical synthesis.

It will be sufficient here to consider

iso-propyl alcohol more fully, as being the more important of the two. Present uses of this alcohol range from motor fuels to the manufacture of cosmetics, but its greatest interest is as a source of acetone by oxidation. Since the production of *iso*-propyl alcohol from cracking gases is comparatively simple, it follows that when economically feasible, the production of acetone from petroleum is a foregone conclusion.

The uses of acetone are well-known, ranging over explosives, solvents, gas storage, cellulose lacquers and motor fuels. Yet its outstanding interest here, like so many other compounds mentioned, is as an intermediate. Here the possibilities cover the general reactions for ketones, and include the production of cyanohydrins, alcohols, amino-compounds, carboxylic acids, and halogen compounds. Of particular interest is the fact that acetone is the basis for the preparation of ketone, a compound of exceeding interest, and at the moment of almost unknown possibilities. Future developments here will certainly prove interesting.

Ethylene Glycol

There are, to-day, three main processes available for the manufacture of ethylene glycol, all of which can be based on raw material from oil. Although the direct production of glycol from petroleum is not yet perhaps very great, it seems reasonable to suppose that large quantities will be so produced in the near future. At the present moment, ethylene glycol is of great importance as a cooling medium for aircraft engines; and after the war it will probably retain its value in civil aviation. It also forms a starting point for the production of more compounds, including glyoxal and oxalic acid, and furthermore it has been used with certain polybasic acids to form alkyd resins of various types, useful in the preparation of paints and varnishes.

Turning next to the production of formaldehyde and acetaldehyde from petroleum, something has been said concerning the latter in the paragraphs on ethyl alcohol; hence only the former will be considered here. Since formaldehyde can be manufactured either from methane or methyl alcohol, both of which are available from petroleum, it seems likely that oil-produced aldehyde will eventually be of great importance.

Importance of Formaldehyde

While formaldehyde forms the basis of many interesting and important compounds, it is in its capacity as a polymerising agent that it is of greatest importance. Owing to the large quantities of formaldehyde required by the plastics industry, and the certain very great expansion of this industry after the war, it seems fair to believe that this compound will eventually be a raw material of front rank importance.

Since the next era will probably be referred to as the "Plastics Age," it follows that any source of suitable raw materials will be fully exploited, and, in the author's opinion, petroleum will be one of the chief sources of supply. Many examples have already been mentioned, and now, having ample supplies of formaldehyde available from oil, we find that the next secondary product for consideration is phenol! Although little phenol is yet manufactured from petroleum, and better methods of production are required, it is felt that these methods are certain to be developed. Then, not only will it be possible to manufacture phenol-formaldehyde resins entirely from petroleum, but yet another intermediate of immense value will be available. With the certainty of its eventual commercial production in large quantities from petroleum, phenol is therefore included here as an intermediate.

The Reactions of Phenol

The reactions of phenol include hydrogenation in the liquid phase over a nickel catalyst, when at temperatures between 100° C. and 150° C., and pressures of some 15 atmospheres, good yields of *cyclo*-hexanol are obtained; and the reaction with sodium hydroxide to produce sodium phenoxide, from which anisole can be derived. The most important reaction at present is undoubtedly nitration to produce the trinitro derivative, known usually as picric acid, and forming the well known explosive lyddite.

Nitration with dilute acid leads to the production of mixed nitrophenols, but by using concentrated acid, the product is substantially trinitrophenol. The lower nitrophenols are readily reduced to aminophenols, used as intermediates

in the dye industry. Likewise, besides forming an important explosive, trinitrophenol itself is of immense importance as an intermediate. A final reference to phenol concerns heating under pressure with a ferric chloride catalyst, when aniline is obtained. The importance of this compound as an intermediate for the preparation of dyes, drugs and explosives requires no emphasis.

Thus from benzene produced from petroleum, phenol and aniline can be produced, and there seems very little doubt that they will eventually be available at an economic price, and will still further increase the importance of oil as the basis of a huge chemical manufacturing industry. Since it is possible to produce benzene from petroleum, and therefore nitrobenzene, the latter compound must be listed here owing to its wide industrial applications.

Treatment of Nitrobenzenes

Mononitrobenzene probably provides the best example of what can be achieved by reduction processes, and a full description would require a treatise of its own. Only the barest outline can be attempted here, but it will at least indicate the possibilities. Reduction in acid-solution, using either tin or zinc metallic catalysts, yields aniline. Thus a second way to the manufacture of coal-tar derivatives from petroleum is opened up. If the reduction, however, is carried out in alkaline solution, using zinc as catalyst, the first stage yields azoxybenzene; the second stage, azobenzene; and the final stage hydrazobenzene. The process can be stopped at any point, and thus is so flexible that any one of the desired compounds can be obtained as the chief yield.

It is worth noting that benzidine can be obtained by the further treatment of hydrazobenzene. Reduction of nitrobenzene by electrolysis in sulphuric acid solution yields aminophenol, from which di-hydric phenols may be synthesised, while the normal reduction in neutral solution, with a zinc catalyst, yields phenylhydroxyamine.

The production of benzaldehyde from petroleum toluene appears a very likely post-war industry, and the further syntheses based on the aldehyde are of great importance. Benzaldehyde forms the basis of the very numerous benzyl compounds, including such important intermediates as benzoic acid, benzal chloride, benzoin, benzyl alcohol and benzyl chloride.

By the application of Perkin's synthesis, numerous unsaturated aromatic acids may then be prepared, *e.g.*, cinnamic; while condensations such as that utilising dimethylaniline and metallic zinc lead to the formation of the valuable triphenylmethane dyes. The last basic raw material, benzoic acid, was included merely to draw attention to the fact that two valuable medicinal compounds, *viz.*, "aspirin" and methyl salicylate, can be quite easily synthesised from petroleum products.

While there are obviously many hundreds of other possibilities which will suggest themselves, it is felt that sufficient has been said in the preceding pages to give an outline of the near-future prospects of petroleum as a basic raw material for chemical manufactures. Since the "catalogue" effect appears to be becoming more and more evident, it is time to see what conclusions can be drawn from the preceding pages. Before doing so, however, reference must be made briefly to a number of important omissions, for which space alone is to blame.

Oxidation of Waxes

For example, nothing has been said regarding the oxidation of the higher paraffins of the wax type, to produce fatty acids. While little commercial production has yet been achieved, some waxes, particularly those from the Fischer-Tropsch synthesis, can be satisfactorily processed, and good yields of fatty acids obtained. Then again, very little has been said about the Friedel and Crafts condensation processes. With aromatics available from petroleum, the prospects here are excellent for further research.

Thus by using benzene and ethyl chloride in the presence of aluminium chloride, many alkylbenzenes can be prepared. Using butyl chloride and butyl alcohol with the aluminium compound, tertiary butyl phenols can be synthesised. Again, under pressure, benzophenone may be obtained from benzene and carbon dioxide in the presence of aluminium chloride. The interesting point here is that with the exception of the aluminium chloride and carbon dioxide, all the materials mentioned can be obtained from petroleum; and in many respects

synthesis from petroleum is mainly "self-contained."

Lastly, among the interesting compounds that have received no previous mention, is a class of raw materials present in petroleum, which includes such things as naphthenic acids, sulphur compounds, sulphonic acids, and nitrogen bases, usually regarded as impurities. All these are obtained in various forms during the refining of different petroleum products, and are usually very complex mixtures. For this reason they have not been included in the general survey, but they are too full of promise to be completely ignored.

The Uses of "Impurities"

Although these "impurities" are present in many cases in very small percentages, because of the vast production of crude oil, many thousands of tons of each are annually available. In spite of their complexity, uses have been found for them, *e.g.*, the preparation of metallic naphthenates as paint "driers" and the preparation of various sulphonates as emulsifiers.

Greater knowledge and new processes will lead to many important new compounds of the thio-ether, mercaptan and pyridine type, from the so-called "waste products" of the oil industry. The main conclusion to be drawn from all this must be that to-day petroleum is well on the way to being the most important raw material available for synthesis.

While many of the processes previously mentioned are already commercial propositions, others are only in the experimental stage, and a certain criticism will be that in many cases these processes cannot compete economically with other recognised processes based on other raw materials. A second criticism will be that there are too many steps between raw material and finished article. The reply to the first is that most new syntheses and processes are uneconomic at first, and further research will remedy this position. Considering the second criticism, the yield of coal-tar from coal averages some 6 per cent., while benzene and toluene are available in somewhat larger quantities. These are the basis of the coal-tar chemical industry, and the only difference between it and the petroleum chemical industry is one step, *i.e.*, catalytic cyclisation to produce aromatics; and this process is becoming so widespread in the oil industry itself that the respective positions of coal and oil, at any rate, will be about equal. In the author's opinion, all the advantages will soon be with the petroleum industry.

For example, considering oil as a raw material for other purposes than the preparation of fuels, lubricants, and road-surfaces, let us take the position of our own country. Many attempts have been made to find oil in commercial quantities, with little success. But the small amounts that can be produced, together with comparatively large quantities of natural gas, mainly methane, might easily form the basis of a new chemical manufacturing industry. This point might be of even greater importance to countries producing appreciable quantities of oil, but still insufficient for national requirements, *e.g.*, France. It could easily be supposed that it would be more economical to import finished petroleum products from other sources, and use the home produced crude as the basis of chemical manufacture.

Oil-Shale Possibilities

Again, with such an easily transported and handled raw material as oil, it also seems probable that chemical manufacturers will import suitable grades, and "crack" it themselves, and then proceed to synthesise huge numbers of chemical compounds from the gases so produced. Returning again to the position of this country, although the production of crude oil is so small, there is another raw material available in huge quantities, *i.e.*, oil-shale. While not quite the same as petroleum in chemical composition, shale-oil might be even more valuable as a basis for synthesis, owing to its higher content of aromatic and unsaturated hydrocarbons.

As a source of refined oil products, crude shale oil has proved difficult to handle, but as a source of valuable "cracking" gases, it may yet have a great future as a basis of home-produced chemical compounds. It is hoped that this article, in spite of being in such an incomplete and summarised form, will prove of interest, and, showing as it does how petroleum can produce compounds of vital importance to most of the world's greatest industries, will help in some small way to stimulate still further research. There are many interesting problems awaiting attention, the solution of which will still further increase the value of petroleum as a raw material.

LETTER TO THE EDITOR

Barytes Production

SIR,—I have read with much interest Mr. O'Brien's letter in THE CHEMICAL AGE of March 6, and I fully agree with him that it is my duty as a citizen to notify the facts concerned to the proper authorities, as he suggests. The minefield which I mentioned as being capable of providing a tonnage of 50,000 to 100,000 tons a year, is, however, no hidden mystery, but a well-known domestic minefield comprising several mines now under various ownership, and I am even now preparing a list of the mines contained therein which I intend to pass to the proper quarter; the Government department concerned and the British Barytes Producers' Association will undoubtedly be able to trace the present owners.

The matter does not end there, however; my contention is that the authorities connected with the Miscellaneous Chemicals Control and the B.B.P.A. do not appear to appreciate the advantages of modern working methods, which alone would enable them to obtain the requisite bulk of true white finely-milled barytes powder at economic cost. I am perfectly prepared to conduct operations involving these up-to-date methods provided that I can receive all the co-operation and assistance that I consider necessary. Final selection of ore bodies, method of treatment, and plant design would have to be left in my hands, as there is no point in making disclosures when the result would merely be the repetition of out-of-date practices.

As my original article indicated, I am aiming at production for post-war export, over and above the satisfaction of the needs of this country. Under the present system of working it is a hard enough job to approach the nearest goal; it is quite obvious, therefore, that drastic reform of methods is required before we can hope to reach a tonnage affording an exportable surplus.—Yours faithfully,

W. H. REYNOLDS.

March 16th.

NEW ATTACK ON SILICOSIS

A new attempt to check silicosis in the ceramic industries by eliminating the actual sources of the dust is urged in a report just issued by a committee headed by Mr. A. W. Garrett, Chief Inspector of Factories. Recommendations include the provision of a certificate by the Chef Inspector of Factories before any construction or reconstruction work is started; the formulation of a code of regulations, in which workers and employers should co-operate; the prohibition of the employment of women and young persons in certain processes; and the adoption of automatic dust conveyance.

Fuel Efficiency Talks

Experts Raise Problems

THE Industrial Fuel Efficiency campaign is being extended by promoting an exchange of ideas between different industries, and at a meeting in London recently, sponsored by the Fuel Efficiency Committee, leading experts were present from the iron and steel, ironfounding, nickel, glass, pottery, refractories, cement, and lime industries, all of which had in common the use of high temperature in their processes. In their discussions it was pointed out that there was great scope for saving fuel in the design of furnaces themselves, while the importance of keeping regular records of fuel consumption per unit of output was stressed, and also of watching the variations which were dependent on the shop programme. The use of instructional films was advocated and emphasis laid on the value of education.

It was stated by Mr. C. P. Taylor (Associated Portland Cement Co., Ltd.), that in the cement industry, having a known weight of calcium carbonate, they were in the fortunate position of being able to calculate their fuel consumption from an analysis of flue gases, and this was more accurate than using a weighbridge. Efficient insulation of kilns, except on the crowns, was not practicable, as they would not stand up to the increase in temperature. Rotary kilns were obviously difficult to insulate. A large amount of heat was absorbed in drying out the slurry, and attempts had been made in this country, though unsuccessfully, to use a dry mixing process. In the United States, where the material was more crystalline, dry mixing had been satisfactorily introduced.

Waste Gases

The question of utilising waste gases from high-temperature furnaces for mould and core drying was also discussed. Mr. Driscoll (Fuel Efficiency Officer of the Ironfounding Industry) said that cupola furnaces were the largest consuming units in the industry. A large volume of hot gas was evolved at a temperature of about 200°-400°C., except during the last part of the melt, when it rose to 1000°C. Their use was restricted to core and mould drying on account of the intermittency of the process. The possibility of storing the gas, which contained 12 to 13 per cent. CO_2 was discussed, but it was considered that its calorific value was too low to enable the mixture to be burnt when cold. Mr. Green (British Refractories Research Association) added that in their industry fuel economy was considered largely from the users' point of view. It was recommended that the possibilities of using waste heat, where it was not required in the process, should be investigated.

Some Pointers of Safety Wisdom—V

by JOHN CREEVEY

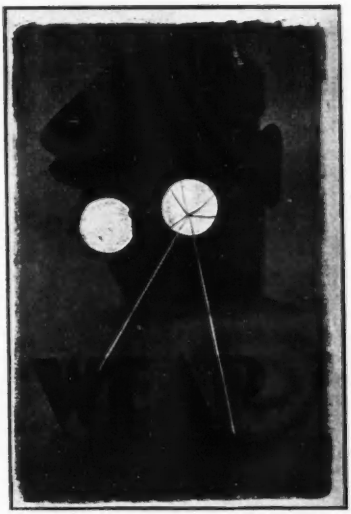
BECAUSE appliances are described as "foolproof," do not feel assured that they can be safely left in the care of "fools." Intelligence among unskilled labour varies widely, and new employees in this class must be kept under observation for a while to ascertain how much responsibility can be entrusted to them. Even among skilled workers there is varying responsiveness to instructions, and those taking their first post in industry—direct from the atmosphere of college—are sometimes found to have a complete disregard for "minor details."

If a man knows "what he is doing" and "why this way and not that," he finds greater interest in his task; therefore educate new employees rather more than would appear to be really necessary. Intelligent questions should be answered readily and not evaded; if a man is worth employing, he should be regarded as one capable of honour for "minor secrets" of the works. Once-upon-a-time there was a works manager who was very vague in his instructions, lest some insignificant detail of operations should get abroad as common knowledge; his instructions concerning the disposal of filtrate and precipitate on one occasion were so shrouded in mystery that many pounds' worth of filtrate went down the drain, and a valueless precipitate was scraped from the filter cloth, the original batch of material having been a concentrated solution of cadmium nitrate, which had become badly contaminated with cadmium sulphide in precipitation due to leakage of sulphuretted hydrogen from adjacent plant, and concerning which it had been deemed "advisable" to be reticent.

When a valve does not operate satisfactorily, the matter must be reported, and if the plant is in operation the maintenance fitter should be in attendance to put the trouble right—if that can be done safely and immediately; do not force the valve, but in the circumstances of being unable to operate it, take precautions for the safety of the plant if the valve is an important one. To ensure "working order," all valves on plant in operation should be tried for easy opening or closing at the commencement of each working shift, and a note recorded in the plant "log" or operating report.

Plug cocks made of acid-proof stoneware or earthenware sometimes have a tendency to "stick" if they have been ill-treated in usage. Loosening the plug by tapping with a mallet is hazardous, because the plug may lift suddenly and allow liquid to spurt over the hands or into the face. It is far better that such plug cocks should be fitted with safe opening and closing springs which can be supplied by the makers; these springs apply the correct pressure to keep the plug in its seating, with liquor tightness, and at the same time permit easy movement. A refinement of this safety feature allows the plug to be locked in any desired position intermediate between fully open and closed.

The plant "log" or operating report, if properly entered up, will provide some useful information in the unfortunate event of an accident from operational causes. Psychologically, too, it has its useful aspect, for if there be sufficient facts to be entered, the entering thereof keeps the mind alert; dull monotony in detail, likewise has tendency to promote disregard for the utility of the facts. It should be the duty of someone in authority to educate plant personnel upon the keeping of a log.



Leakage from tanks, drippage of liquid from overhead, escape of noxious fumes, excessive steaming of cooling water as it emerges from a pipe outlet, and sparks from the chimney of a furnace, are all matters which need reporting, making no excuse for the fact that "the other fellow" may have already done so.

When tools have been left lying in a gangway, or otherwise in a dangerous position to persons passing, it is the duty of those who observe to take measures to remove the hazard, reporting the fact to the person responsible (or to someone in authority). The man wheeling a truck may not be able to see a small object which is in the path

of the truck wheels; the man dislodging a tool left in a footway overhead rarely has time to prevent it from falling; the vibration of machinery, which is a common cause of tools rolling, needs human co-operation in avoiding the use of a hazardous resting place. Let fitters bear in mind that "water hammer" can easily dislodge tools which are resting across a couple of steam pipes; in overhead situations, among pipework, tools should be kept under safe conditions by use of a strong canvas sling which can be fixed securely to pipes or constructional steelwork.

Drums which are left lying on their side about the works, and especially when on the plant for slow filling or emptying, should have a hardwood block to prevent accidental rolling. About the works, even when there is no risk of rolling, the use of the block will prevent uncontrolled movement by impact from a motor lorry which has skidded or is backing without due precaution.

Dizziness, or other unusual symptoms, observed in plant operation, should be reported to the works medical officer or to the works manager; there may be an unexpected hazard when a new process is in operation, for let it be recalled that a large chemical works had this experience some years back and with unexpected suddenness were faced with several fatalities from fumes which proved to be poisonous but in presence were unsuspected.

When the works fire alarm sounds, it is the duty of those in charge of plant units to ascertain whether or not the outbreak offers any danger to the plant in their care; the fire fighting is done by the works fire brigade, and if additional assistance is needed it will be called for. Youthful personnel should be reminded that observers only impede the work of those engaged in quelling the outbreak. In the case of a small works it is possible that the "works brigade" by necessity includes all employees who can muster without danger to plant in operation, which must be made "safe" before being left unattended.

Co-operation between employees promotes general safety. The observance or suspicion of a hazard, duly reported, should have immediate attention, and the person who reported it should be acquainted with what has transpired; only by this "reporting

back" can the co-operation be kept fully alive. The man who has reported, and hears nothing further, may lack interest in the future, excepting for circumstances of direct concern. Co-operation between rival works producing a particular product or operating similar processes must also be fostered, the details of any new hazard or

accident being communicated from one to another, or brought to the notice of the industry generally by publicity in the trade papers.

The achievement of an accident-free record must not reduce vigilance in the matter of acquiring safety knowledge and bringing it to the notice of employees; only by keeping safety-minded can the good record be maintained. It is well to remember that some piece of plant, now idle, may be in operation again, and that a slight change in operating technique can offer hazards which have been almost forgotten.

An excellent method of impressing on employees the need for precautions is the use of industrial safety posters, three of which are used to illustrate these notes. In these posters, produced for the Ministry of Labour and National Service by the Royal Society for the Prevention of Accidents, the industrial worker is seeing really front rank commercial design of a quality that is hardly available to the general public at the present time. If placed in prominent positions in the works, and changed from time to time, they will catch the eye of all, and act as a continual reminder of the dangers of not keeping up to scratch.

Industrial Safety Gleanings

Protecting Acid Workers : Hydrogen Sulphide Gas

WHAT protective clothing is recommended for workers handling acid, is a question often asked in industrial premises. The usual protective clothing for this work includes chemical type goggles, if heavy splashing is likely. Otherwise, and especially if the goggles have to be warn for long periods, protective spectacles with side shields should be provided. As these are more comfortable than the chemical type, they are more likely to be warn regularly. An acid-proof apron, long enough to hang below the top of the boots, and rubber gloves are also necessary. The gloves may have long gauntlets or a short type may be worn with woollen oversleeves. The latter should have elastic inserted at each end so that they grip the wrist of the gloves and the upper arm. It is important that woollen material be used. Rubber wellingtons are also needed. Assistance may be obtained from District Inspectors of Factories if any of the items mentioned are hard to obtain.

Watch for Unusual Happenings

An unusual type of gassing accident due to hydrogen sulphide occurred at a works during the cleaning of one of a battery of four pans used for a process in which hydrogen sulphide was generated. Each pan was connected by a short duct to a common main which itself was connected to an exhaust fan intended to draw the fumes away from the pans. Each duct connecting to the main was fitted with a screw-down valve. One of the pans had been cleaned out by steaming and washing, and a man went inside to carry out some minor alterations. Before he entered, the valve on the exhaust duct was closed and all liquor pipes were disconnected, so that the pan had no connection with any other part of the plant except past the valve in the exhaust duct. On the morning of the accident, the pan was tested, mice being used, while the exhaust fan was running, and as the mice showed no signs of distress, the man entered. He was called away afer a few minutes and when he returned about an hour later, he entered the pan without any further test. He was overcome by hydrogen sulphide fumes, as were two men who went to his assistance without breathing apparatus. Later, it was discovered that the belt had come off the exhaust fan and also that there was a slight leak in the valve on the exhaust duct of the pan.

Treatment of Silicosis

Further studies of aluminium powder in the treatment of silicosis have been reported by Dr. J. L. Blaisdell, Queen Alexandra Sanatorium, London, Ontario, to the Pittsburgh meeting of the Industrial Hygiene Foundation. Selected cases of men exposed to silica dust who were still employed in mining were treated by the daily inhalation of fine metallic aluminium powder, freshly ground from small aluminium pellets in a specially constructed mill. Treatment was begun by five minutes' daily inhalation through the dust mill; the period was gradually increased to 30 minutes daily, and was continued in some cases over almost a year. The investigation has shown conclusively that the administration of aluminium powder in the manner described is entirely harmless; it proved definitely beneficial in 19 out of 34 cases studied.

Aluminium dust cannot be regarded in any sense as a "cure" for silicosis in so far as the restoration to normal of lung tissue that has already undergone fibrotic change is concerned. Its use, however, would appear to be followed by beneficial results, chiefly in the amelioration of symptoms and in the increased capacty to work.

Public Analysts

Annual Meeting : New Officers Elected

THE Society of Public Analysts and other Analytical Chemists held its annual general meeting this month at the Chemical Society's Rooms, Burlington House, London, W.1. The President, Dr. E. B. Hughes, occupied the chair. The hon. treasurer reported a very satisfactory financial year. The report for the past year showed continued growth of membership, which now totalled just over 1000. The activities of the Society and its local Sections had been well maintained, and its journal, *The Analyst*, had had a successful year in spite of severe paper restrictions. The retiring president, Dr. E. B. Hughes, who had occupied the office for three years, was accorded a warm tribute of thanks for his services throughout those difficult years.

The following officials were elected for the coming year:—*President*: S. Ernest Melling, F.I.C.; *Past Presidents serving on the Council*: F. W. F. Arnaud, Bernard Dyer, John Evans, Edward Hinks, E. B. Hughes, G. Roche Lynch, W. H. Roberts, and G. Rudd Thompson; *Vice-Presidents*: H. F. Cox, G. Hogan, T. Rendle, W. Gordon Carey (Chairman, North of England Section), and A. R. Jamieson (chairman, Scottish Section); *Hon. Treasurer*: George Taylor; *Hon. Secretary*: Lewis Eynon; *other Members of Council*: J. W. Corran, R. H. Ellis, J. G. A. Griffiths, D. W. Kent-Jones, R. Lessing, H. M. Mason, B. G. McLellan, M. Pearson, W. H. Simmons, R. W. Sutton, E. Voelcker, K. A. Williams, Arnold Lees (hon. secretary, North of England Section), and R. S. Watson (hon. secretary, Scottish Section). The meeting was followed by an address by Dr. C. A. Mitchell, M.A., F.I.C., on "Ink in Relation to Crime."

Shellac News

Bleachers' New Association

THE British Shellac Bleachers' Association was duly formed at a meeting held at India House, Aldwych, London, W.C.2, on March 3. Mr. A. J. Gibson, the Special Officer Lac Inquiry, was elected interim hon. chairman, Mr. A. F. Suter deputy chairman and treasurer, and Miss I. A. Poyner secretary, with temporary offices at India House. The aims of the Association are to improve, by united effort, the quality and output of British bleached lac, with the ultimate object of participating in the European export trade after the war, till now in foreign hands; to secure the best possible raw materials from India; and generally to build up a sound trade, based on an agreed policy of buying and selling, including the adoption of a trade mark to protect the Association's products. The Association is also keenly interested in a specification for bleached lac, now under consideration by the British Standards Institution.

Analytical Handbook

All trade and research chemists interested in the problems of shellac quality will find great value in the *Handbook of Shellac Analysis*, recently published by the Indian Lac Research Institute. The authors, Mr. M. Rangaswami and Dr. H. K. Sen, Senior Research Chemist and Director, respectively, of the Institute, have greatly furthered one of the main objectives of their Institute, which is to evolve and standardise international methods of lac analysis. British, American, and Indian associations, not to mention commercial firms, have adopted many and various standards for this purpose, and the available literature is unduly scattered. And, although there can be no final agreement until the various trade interests concerned can concur on all the various necessary tests, this Handbook should go far towards enabling them, at all events, to crystallise their ideas. The authors appear justified in their belief that all the relevant information on shellac analysis which could go into one small volume of 124 pages has been included. It is, however, odd, as they say, that the tests employed by certain firms are still kept secret, and have had to be omitted.

APPLIED PHOTOGRAPHY

The Kodak Research Laboratories have issued a number of new data sheets for inclusion in their Kodak Data Book of Applied Photography (*see* THE CHEMICAL AGE, 1942, *47*, 267). A set of cross-indexes lists all sheets issued up to January 1, 1943, and arranges them in two alternative classifications which should make even easier the tracking down of any particular topic. Single sheets deal with the "Industrex" X-ray Illuminator, designed to permit satisfactory examination of radiographs of varying sizes (Y 26), and the Kodak X-Ray Reduction Camera for making copy negatives from radiographs (Y 27). The characteristics of "Microfile" Regular (35 mm.) Safety Film are described on sheet X 39, while the Reflex Copying Process for recording the relief pattern of etched metal surfaces so as to show up fine surface detail is dealt with on sheet D 9. The eight-page booklet, C 3, deals with Photoelastic Stress Analysis by polarised light, using transparent models, and incorporates a useful bibliography on the topic. A valuable twelve-page booklet, A 29, gives full instructions for the proper processing of radiographs. All aspects of this important subject are fully treated, the development stage receiving, as it should, particular attention.

Personal Notes

MR. GEORGE EVETTS has been appointed Gas Adviser to the Ministry of Fuel and Power, consequent upon the resignation of Dr. E. W. Smith from the post of Director of Gas Supplies.

MR. N. L. GOODCHILD, director for Pig Iron, has also been appointed Director for Electrodes in the Iron and Steel Control. Mr. Goodchild joined the Control immediately on the outbreak of war from the Stanton Ironworks Co., Ltd.

MR. A. MASON was elected chairman of the London section of the Textile Institute at the 21st annual meeting, held on March 9. He succeeds MR. W. H. MATTHEWS, chairman for the last two years, who has resigned on grounds of health.

The wedding is announced of MISS ELIZABETH KENT and MR. J. PRINGLE, who is chemist in charge of gas appliance research at Newcastle Gas Company, and has held a similar position at Parkinsons, Birmingham.

MR. H. W. JAMES, A.R.C.S., has retired from the position of manager of the tar distillation works of the South Metropolitan Gas Company after 43 years at the same works and 23 years as manager. He was "taken over" with the works when the company acquired them in 1903, having previously served as assistant chemist to the firm of tar distillers who had operated them earlier. He was particularly interested in road tar, and his work as chairman of the Standardisation of Tar Products Tests Committee of the B.S.I. has continued to bear fruit, a new road-tar specification having been produced only last month. MR. R. A. PROCTOR, M.Sc., deputy manager, is now in charge of the works.

Courage and initiative in dealing with fires at chemical works have led to the award of the M.B.E. to MR. ERIC SHAW, works chemist, Manchester, and to MR. REX ALFRED WARBURTON, B.Sc., chemist with I.C.I. (Explosives), Ltd. Mr. Shaw, aided by Divisional Officer Fleetwood, N.F.S., entered a burning building to isolate material liable to explode, thus preventing the fire from reaching more disastrous proportions. Mr. Warburton discovered an outbreak of fire, gave the alarm, and entered a smoke-filled building where the visibility was nil. Locating by sound the sources of burning, he moved round the building, sweeping burning pots of chemicals into a bucket of water that he was carrying, and dealing with each point of ignition, in the dark, until he was satisfied that there was no further danger from fire. He was fully aware that in the building there was a quantity of explosive which might have ignited at any moment.

MR. H. R. HOWELLS has become Director of Cold Storage in the Ministry of Food in succession to MR. E. F. FARROW, who is retiring on grounds of health. Mr. Howells's position as deputy director is taken by MR. J. N. WALKER, for many years manager for the Union Cold Storage Company in Scotland.

PROFESSOR ALEXANDER FINDLAY, Professor of Chemistry at Aberdeen University since 1919, has decided to resign on September 30 in consequence of his election as president of the Institute of Chemistry. He had intended to retire some time ago, but when his chosen successor, Professor Harry Melville, received a war-time Government post, Professor Findlay agreed to stay in office.

New Control Orders

Control of Lac

THE Control of Lac (No. 2) Order, 1943 (S. R. & O. 1943, No. 323) prohibits, as from March 15, the sale, disposal, and use for any purpose of lac, except under licence from the Ministry of Supply. Lac is defined as the resinous secretion of the lac insect whether in the form of sticklac, seedlac, buttonlac, shellac, recovered lac or any other form. Direction No. 1 (S. R. & O. 1943, No. 324) printed with the Order, allows the acquisition and use, without licence, of quantities not aggregating more than 164 lbs. in any calendar month.

Applications for licences to dispose of, acquire or use lac should be made to the Miscellaneous Chemicals Control, 52 Grosvenor Gardens, London, S.W.1. All applications must show the applicant's stocks of each grade held and their situation on the date of the application, and applications for licences to acquire or use lac must show the description of each use and the rate of consumption per month for each use.

Parliamentary Topics

Creosote as Fuel Oil

IN the House of Commons last week Mr. Thorne asked the Minister of Fuel and Power whether he could give any information about the use of creosote in furnaces in many large factories; and whether this by-product could be used for better purposes. Major Lloyd George replied that after meeting requirements for certain essential industries, substantial quantities of creosote and pitch were available for use as fuel. In order to save imported fuel oil, the Minister of Fuel and Power had arranged for the conversion of oil-burning furnace and boiler plant to burn a mixture of creosote and pitch. The best possible use was thus made of available supplies of creosote.

General News——From Week to Week

It is announced that the Society of Chemical Industry is transferring its offices, towards the end of this month, from Euston Road to 56 Victoria Street, in the block of buildings that already houses the Institution of Chemical Engineers.

The Control of Derris (No. 2) Order, 1943, effective as from March, 1943, has been extended to include, within the definition of "controlled material" in the No. 1 Order, any variety of Lonchocarpus (*e.g.*, timbo, barbasco, or cubé) whether as a root or as powder.

A leaflet entitled "Interesting War-Work in the Engineering Industry" has been issued by the Ministry of Labour and National Service, setting out details of the Government training scheme for men and women who are ineligible for military service and wish to enter the engineering industry.

The Institute of Export has just published a "Guide to the Mechanics of Export Trade," price 5s. 3d., post free from the Institute, Royal Empire Society Building, Northumberland Avenue, London, W.C.2. This little book of 110 pages comes at an opportune moment and serves as a useful correspondence course for all who wish to embark on export trade as a career.

Containers made entirely from paper are now being used for transporting lead in bulk. Previously, the lead was carried in wood-lined metal boxes, but cardboard boxes with the corners reinforced have been proved tough enough for this purpose. As a test of durability one of these containers was filled with 90 lb. of lead and sent on a 10,000 mile journey. It returned in perfect condition.

No changes in the wholesale prices of coal (Board of Trade index figure 185.8), iron and steel (182.7), non-ferrous metals (126.0), or chemicals and oils (142.7), were made last month from the January figures. A decline from 162.6 to 162.2 was shown in the overall price of industrial materials and manufactures for the month of February. This is 0.3 per cent. less than in January of this year, and only 2.0 per cent. more than in February, 1942.

The Fuel Efficiency Committee has already covered a wide field in the industrial use of fuel, but in order as far as possible to reduce the consumption of imported oil, a special sub-committee of experts has now been set up under the chairmanship of Dr. A. E. Dunstan to consider means whereby this may be achieved. A bulletin on the efficient utilisation of liquid fuel is being prepared and will shortly be issued to industrial consumers.

The Trading with the Enemy (Specified Persons) (Amendment) (No. 4) Order, 1943, has been made by the Board of Trade. It contains about 550 additions to the black list, including Cia. Industrial de Aparatos Cientificos, "Cidac," Peru 151, Buenos Aires; Cia. Metalurgica Comercial Soc. de Resp. Ltda., Av. de Mayo 1370, Buenos Aires; Metalurgica Hofer, 9 de Julio 1019, Tucuman, Argentina; Cia. de Anilinas Productos Chimicos e Material Tecnico, Rua da Alfandega 100-102, Rio de Janeiro; Industria Metalurgica Portoalegrense, Rua Almirante Barroso 285, Porto Alegre, Brazil; Fabrica de Aluminio "Sasco," Valdez 156, Los Placeres, Valparaiso; Chemie-Metall-Trust, Vaduz, Liechtenstein; Opekta A.G. für Chemische und Pharmaceutische Produkte, Zuchwilerstr. 25, Solothurn, and Schweizerische Sodafabrik A.G., Zurzach, and Albangraben 8, Basle, Switzerland. The 60 deletions include Cia. Electro-Chimica Fluminense, Av. Almirante Barroso 81, Rio de Janeiro.

Foreign News

A British Guiana Ordinance of December 30, 1942, reduces the duty on certain iron or steel products by one-half of the former rates.

A company entitled Leichtkunststoffwerke G.m.b.H. has been formed at Riga (Latvia) to engage in the manufacture of light plastics and other substitute products using wood as starting material.

Ecuador has become the second largest source of tree rubber in South America, following Brazil. In 1941, Ecuador produced about 1500 tons and production for 1942 was higher.

Besides the famous Siemens and M.A.N. works at Nuremberg, it is recorded that a chemical factory was among the important industrial concerns damaged in the recent R.A.F. raid on the Bavarian city.

Larger quantities of coal-tar pitch are to be imported into France under the auspices of the Comité d'Organisation de l'Industrie et du Commerce des Goudrons, Benzole et Dérivés, which has been in existence since January, 1941. Before the war, 1,350,000 tons of hard pitch and coal-tar were imported in one year.

A special award "for distinguished service to safety" has been presented to E. I. du Pont de Nemours and Co., Inc., by the National Safety Council of America. Of the Du Pont plants, 38 have had no reportable accident in at least 18 months, and one established a world's record of more than 11,000,000 man-hours without a reportable accident.

The East African territories will manufacture a proportion of their own essential quinine requirements in 1943. Tanganyika's supply of cinchona bark will be made into totaquina in a factory recently started at Dar-es-Salaam.

The first American crop of kok-saghyz (about one acre) planted in New Jersey by the United States Rubber Co., was harvested in January, and is said to show that New Jersey has a good climate for this Russian dandelion.

An estimated shortage of between 800,000,000 and 1,000,000,000 pounds of fats and vegetable oils in America's 1943 requirements for food and industrial purposes, has been brought to the attention of the nation by a Department of Agriculture official. This shortage would be equivalent to 7 to 9 per cent. of present needs, even though some of these have been curtailed by the exclusion of edible oils from industrial use.

Calcium carbide imports into Jamaica in 1941 totalled 78,425 lb. (£901), as against 78,487 lb. in 1940. Imports of fertilisers, mineral and chemical, amounted to 8049 tons (£83,837), a decline from the previous year's total of 19,164 (£112,525). Imports of disinfectants were valued at £5110, insecticides and fungicides at £20,698, tanning and dyeing materials at £5624, and other kinds of chemicals at £67,781.

An "electrostatic grading" process, for sorting small flake mica according to the thinness of the flakes, has been developed by the U.S. Bureau of Mines. The mica is placed on a shaking table and subjected to charges from a grid electrode above and parallel to the table. The thinnest flakes are most buoyed by the electrostatic forces, and thus are separated from the thicker flakes.

Shipment of petroleum products from the United States to Spain have ceased since February, 1942, according to a letter addressed by Mr. Sumner Welles to Mr. Sol Bloom, chairman of the Foreign Affairs Committee of the House of Representatives. In 1941, 227,347 metric tons of petroleum products were exported to Spain; in 1942, only 17,771 tons. Future shipments from South America will be subject to the assent of the British and American Governments.

Australian production of power alcohol will shortly reach approximately 19,000,000 gallons annually, sugar, tar, and molasses being used as raw materials. In addition, wineries are potential sources annually of 5,000,000 gallons of 94 per cent. power alcohol. The Australian Government has announced special powers to control shale oils and substitute fuels. Distillates from shale or coal and the rectified spirits now being marketed without the surrender of ration tickets are covered by amended regulations.

The manufacture of anhydrous sodium metasilicate is announced by the Philadelphia Quartz Company, and production on a commercial scale is in full swing. The material is specially sized to reduce dustiness and permit ready solubility. It is compatible with soap, wetting agents, caustic soda and phosphates of soda. Wax-lined barrels and fibre drums are employed as containers.

Forthcoming Events

Four lectures on the modern power station are being given before the **Royal Society of Arts.** The second, on "Coal and Ash Handling Plant," by Mr. J. F. Roy Mitchell, will be at 1.45 p.m. on **March 22,** while the third, on "The Mechanical Equipment of the Turbine House," by Mr. F. Shakeshaft, will be at the same time on **March 29.**

Sir Henry Dale is giving a series of four lectures on chemistry in modern medicinal treatment before the **Royal Institution,** at 3 p.m. on Tuesdays. The second, on **March 23,** will be on "Imitating Nature," and the third, on **March 30,** on "The Beginning of Chemotherapy."

There will be a meeting of the **Institute of Chemistry** and the **Society of Chemical Industry** jointly with the **Leeds University Chemical Society,** in the chemistry lecture theatre of Leeds University, on **March 23.** A discussion on "The Training of the Industrial Chemist" will be opened by Professor F. M. Rowe and a student at 6.15 p.m.

The annual meeting of the Yorkshire section of the **Textile Institute** will be held at the Midland Hotel, Bradford, at 6.30 p.m., on **March 25.**

The Plastics Group and the Birmingham and Midlands section of the **Society of Chemical Industry** will meet jointly on **March 26,** at 2.30 p.m., in the Birmingham Chamber of Commerce, when Dr. F. T. Barwell and Dr. K. W. Pepper will speak on "Paper Base Plastics—Part II."

There will be a joint meeting of the **Chemical Engineering Group,** the **Institution of Chemical Engineers,** and the **Society of Chemical Industry,** Glasgow section, at 7.15 p.m., on **March 26,** in the Societies Room, Royal Technical College, Glasgow, when a paper on "Multiple-Effect Evaporation in the Sugar Industry" will be presented by Mr. D. M. Semple.

At a meeting of the **Mineralogical Society,** at 4.45 p.m., on **March 28,** in the Geological Society's rooms, Burlington House, Professor W. T. Gordon will give a lecture entitled "Industrial Diamond."

Commercial Intelligence

The following are taken from printed reports, but we cannot be responsible for errors that may occur.

Mortgages and Charges

(Note.—The Companies Consolidation Act of 1908 provides that every Mortgage or Charge, as described therein, shall be registered within 21 days after its creation, otherwise it shall be void against the liquidator and any creditor. The Act also provides that every company shall, in making its Annual Summary, specify the total amount of debt due from the company in respect of all Mortgages or Charges. The following Mortgages and Charges have been so registered. In each case the total debt, as specified in the last available Annual Summary, is also given—marked with an *—followed by the date of the Summary, but such total may have been reduced.)

METAL ABRASIVES, LTD., London, W. (M., 20/3/43.) March 3, £200 debentures, part of a series already registered.

Company News

Benzol and By-Products, Ltd., are paying arrears of preference dividends for the six months to September 30, 1932.

Lacrinoid Products, Ltd., announce a final dividend of 5 per cent., making 9 per cent. (same) for 1942.

The Electrolytic Zinc Co. of Australasia, Ltd., announce an interim dividend of 4 per cent. (same).

Blythe Colour Works, Ltd., announce an ordinary dividend of 5 per cent. (same) in respect of the year to December 31, 1942, and a net profit of £33,506 (£22,280).

Hadfields, Ltd., announce a final dividend of 15 per cent., making 22½ per cent. for 1942 (same), and a net profit of £202,264 (£198,904).

Chemical and Allied Stocks and Shares

ALTHOUGH there was no appreciable improvement in the volume of business, a firm undertone has continued to rule in the stock and share markets, and on balance there were a fair number of gains in industrial securities. Nevertheless, sentiment generally was influenced by the tendency to await the next war developments. A disposition to await the Budget also had a restraining influence on markets. Imperial Chemical continued to improve, pending the dividend statement, it being pointed out that at around the current level of 39s. 1½d. the yield is still rather higher than the return on various other leading industrial shares. Firmness was maintained in B. Laporte at 78s. Fisons have changed hands up to 45s., while British Drug Houses were again 22s. 6d. Monsanto Chemicals 5½ per cent. preference were also unchanged at 22s. 6d. Courtaulds at 48s. 9d. showed a good rally on balance, sentiment having remained under the influence of the annual statement and the reference to the possibility of expansion in the company's activities. British Celanese at 17s. 1½d. were also better, and other rayon shares tended to improve. Moreover, Bradford Dyers ordinary and preference were firm at 15s. 3d. and 19s. 3d. respectively, aided by the results and the payment of the remaining arrears of preference dividend.

Lever & Unilever at 35s. 3d. were moderately higher. In fact, despite small current yields, and little prospect of early improvement in dividend payments, a number of shares continued to attract attention on hopeful market views as to post-war prospects. Barry & Staines reached 44s. 3d. and subsequently moved back to 42s. 6d., but nevertheless showed a rise on balance, while Nairn & Greenwich moved up to 65s., and Wall Paper Manufacturers deferred were 37s. 6d. Elsewhere, Associated Cement were firm at 58s. 9d., as were British Plaster Board 5s. shares at 27s. 6d. Greeff-Chemicals 5s. ordinary transferred up to 7s. 10½d. British Oxygen showed firmness at 77s. 3d. awaiting the forthcoming dividend announcement, and British Aluminium at 49s. 6d. were little changed. At 34s. 9d. Dunlop Rubber were 3d. better on balance. Among iron and steel issues, Stewarts & Lloyds were firm at 54s. 3d., and Tube Investments 93s. 3d., while Dorman Long were 24s. 6d., and United Steel 25s. 10½d.

Activity was again shown in shares of companies with interests in plastics. British Industrial Plastics 2s. shares changed hands between 5s. 9d. and 6s., Thomas De La Rue between 88s. 1½d. and 90s., and Lacrinoid Products around 4s. 7½d. Erinoid 5s. ordinary were 11s. 3d. In other directions, the units of the Distillers Co. were firm at 87s., but United Molasses ordinary eased slightly to 28s. 9d., and Triplex Glass were easier at 30s. 9d. The shares of the Metal Box Co. were higher at 84s. 3d. Gains were recorded among paint shares, including International Paint, Pinchin Johnson, Paripan, and Blundell Spence, the last-named having remained under the influence of the higher dividend. Cellon 5s. ordinary were again quoted at 17s. 6d.

In other directions, Boots Drug were firm at 40s. 6d., and Timothy Whites improved to 27s. 10½d., while Sangers were 22s. Elsewhere, Beechams Pills deferred moved higher to 14s. 6d. on yield considerations. Borax Consolidated deferred were better at 34s. 4½d., it being realised that the 7½ per cent. dividend is again a conservative payment; earnings on the deferred units last year exceeded this rate by nearly 5¼ per cent. Imperial Smelting were slighly better at 13s., while at 16s. 3d. General Refractories more than maintained their recent

rise, hopes having persisted in the market of an improved dividend for the past year. Amalgamated Metal shares were again 15s. 6d. Elsewhere, Birmid Industries were around 84s. Anglo-Iranian and other leading oil shares tended to have a firmer appearance.

British Chemical Prices

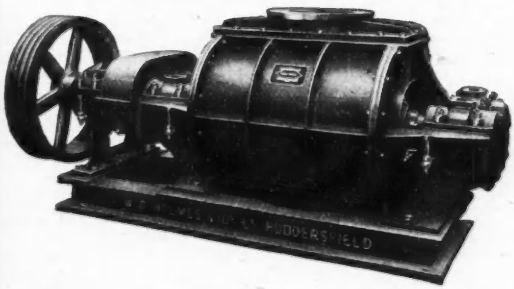
Market Reports

MOST traders report reasonably satisfactory trading conditions in the general chemicals market this week, due allowance being made for the difficulties created by the tight supply position in several sections. Contract specifications are circulating fairly freely and a moderate weight of fresh business has been reported. Prices generally remain on a strong basis. Among the soda products the call for supplies of both salt cake and Glauber salt has been steady and fair quantities of hyposulphite of soda and nitrate of soda are being taken up. There has been no change in the position of either soda ash or bicarbonate of soda and sellers are meeting with a steady call for supplies. Acetate of soda is steady. Generally strong price conditions and a persistent demand for the quantities on offer are the main features of the market for potash chemicals. British-made formaldehyde meets with a steady inquiry and a fair amount of interest is shown in borax. White powdered arsenic, the various grades of sulphur, and carbide of calcium are all very firm. A continued steady business is reported in the white and red leads and the ready-mixed paints, and makers indicate a fair amount of new inquiry. A good trade is passing in zinc oxide. Market conditions for the coal-tar products show no material change on the week and prices for most items remain steady at recent levels. Creosote oil, cresylic and carbolic acid, and pitch are in good demand.

MANCHESTER.—Price conditions are very firm in virtually all sections of the Manchester chemical market, though the past week has again witnessed little in the way of actual movements. The call for contract deliveries of most of the alkalis has been on steady lines and a moderate weight of new inquiry has been in evidence. The acids are mostly being taken up in good quantities and a steady trade is passing in alum, borax, and the general run of ammonia and magnesia products. The tar products are firm in price and mostly in active demand.

GLASGOW.—There is no change to report in the Scottish heavy chemical trade during the past week for home business with the steady day-to-day transactions. Export business remains rather limited. Prices continue firm.

HOLMES-CONNERSVILLE
POSITIVE AIR BLOWERS



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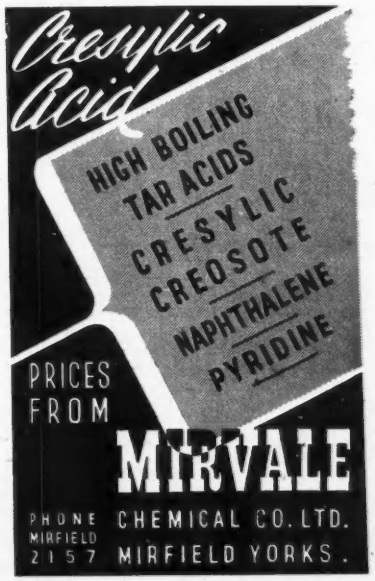

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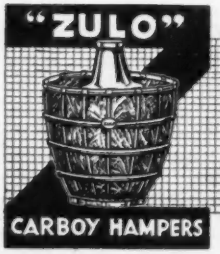

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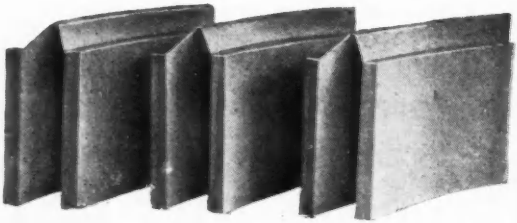

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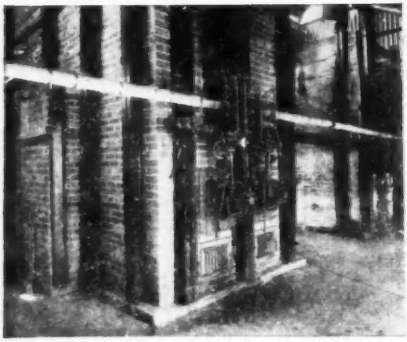

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